PRODUCT OVERVIEW

Lupulin powder and de-bittered leaf are produced from whole leaf hops using YCH HOPS’ proprietary cryogenic separation process which preserves all components of each fraction.

Lupulin hop powder is purified lupulin powder containing most of the resin compounds and aromatic oils derived directly from whole hop flowers. It is ideal for use in the whirlpool or fermenter, imparting intense hop flavor and aroma with minimal vegetal flavor and improved yield.

Used in combination with Resinate® CO2 extract, lupulin hop powder can add hop aroma and flavor to the end of boil or in dry hopping for a twofold approach to achieving superior brewery efficiency without sacrificing flavor. Depending on the quantity of hop pellets or whole leaf that is replaced by either of these products, breweries may see significant improvements in beer yield which contribute to the the bottom line and sustainability mission of YCH HOPS and many of our customers.

Debittered leaf is the leafy part of the hop cone (bract and strig) which has had most of the lupulin removed resulting in a “de-bittered” hop. Debittered leaf is a high quality, low alpha alternative to provide noble character in beer. Analytically, debittered leaf appears similar in character to noble hops but may be derived from higher resin Northwest varieties such as Simcoe®, Mosaic® and Cascade.

Debittered leaf may be used anywhere hop pellets may be used, and in any style, particularly Pilsner, Kölsch, Blonde, and sour styles including Gose, Gueuze, and Berliner Weisse.

THE PRODUCTION PROCESS

Lupulin powder and debittered leaf are produced simultaneously when whole hop cones are split into purified lupulin and bract fractions with YCH HOPS’ proprietary Cryo Hops™ process. The process occurs at very low temperatures and in a nitrogen atmosphere avoiding opportunities for oxidation of sensitive resins and oils. The resulting products are immediately packaged in standard nitrogen-flushed, flexible foil packaging.

BENEFITS OF UTILIZING LUPULIN HOP POWDER

Lupulin powder enables a brewer to use large doses of hops to achieve intense hop aroma and flavor without introducing material from pellets or whole leaf products which reduce yield and can contribute undesired vegetal or astringent flavors. At lower doses, lupulin powder can create low bitterness beers that have enhanced hop flavor with particularly juicy, resinous and fruity characteristics.

- Concentrated alpha and oil for increased hop flavor and aroma
- Lower solids loading in kettle or fermenter for higher yields from reduced trub
- Reduced vegetal flavors at high hopping rates
- Minimal processing; no solvents, heat or pressure

APPLICATION & USAGE

Lupulin powder may be used anywhere pellet hops are utilized and are best used for late kettle and dry hop additions. A starting point for recipe formulation or modification dose rate is estimated at 50% of pellets by weight. It is best used in beers defined by their hop flavor and aroma with hop loads of at least 1 lb/bbl in late kettle or dry hop additions where a larger yield increase will occur from substituting out hop pellets or whole leaf.

<table>
<thead>
<tr>
<th>Addition</th>
<th>Current Recipe</th>
<th>Lupulin Powder</th>
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<tbody>
<tr>
<td>60 or 90 minutes</td>
<td>CO2 Hop Extract Hop Pellets</td>
<td>CO2 Hop Extract Hop Pellets</td>
</tr>
<tr>
<td>15 Minute</td>
<td>Hop Pellets</td>
<td>Hop Pellets</td>
</tr>
<tr>
<td>Whirlpool</td>
<td>1 lb/bbl Pellets</td>
<td>0.5 lb/bbl Lupulin</td>
</tr>
<tr>
<td>Dry Hop</td>
<td>1 lb/bbl Pellets</td>
<td>0.5 lb/bbl Lupulin</td>
</tr>
</tbody>
</table>

example substitution for basic Double IPA hop bill